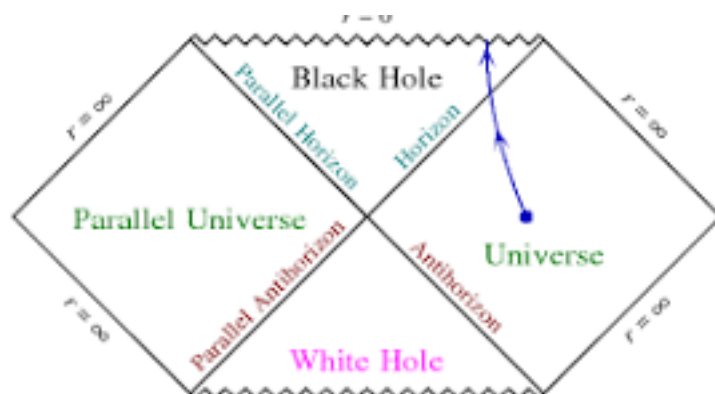


An introduction to worm holing between two universes and black and white holes (For Swartchild black holes, for now)

Introduction to the idea – This idea is inspired by the many theories that suggest that black and white holes can possibly be connected by some sort of structure, that we call wormholes. We will discuss about them today. This paper will heavily structure upon the ideas mentioned in the last volume of this physics series. Please do read the second and first volumes if you have not.

Starting on the concept – The basic idea implied by all these theories is that a black hole, white hole, and two different universes are connected in this fashion: -

(Sorry for the terrible resolution, Safari didn't download this properly)



In this paper, I mean to help you understand what this diagram means and maybe even explain it to other people.

Let us start by understanding what each of the parts of the diagram is showing.

Universes and Parallel Universes

When we are talking about the universe, we think about just ours, but in reality, scientists think there could even be an INFINITE number of universes. Now, the Universe we live in is simply termed as “The

Universe”, but, what about the other universes? Well, these universes, we term as “Parallel Universes”. In a Parallel universe, scientists think that everything runs different to our universe, for example, if you preferred oatmeal over cereal in our universe, you would choose cereal in the parallel universe.

White and black holes

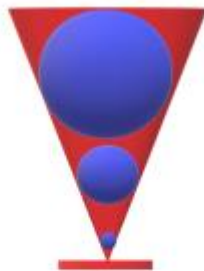
*Black and white holes, as an overview will be talked about here, to see the full explanation, see the first two papers. *

Black holes are basically the outcomes of the life of a star ending, and all its mass collapsing in on itself, causing an extremely dense collection of matter to form, thus making a black hole. This black hole curves spacetime infinitely, causing escape past the event horizon (point of no return) impossible. A white hole is nothing but the opposite of the black hole, instead of pulling mass and matter in faster than the speed of light, it instead ejects matter outwards faster than the speed of light.

Light cones

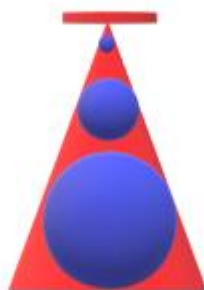
You must have known about these from the first two papers, here is the explanation from the first and second papers:

Imagine there is a person who is moving through time and has a helmet that sends out a sphere of light outwards, as he is moving through time, the light spreads out to form a cone in his future. Here is a diagram



This is his future cone, everything he will ever do is contained in this cone, since the sphere of light moves at the speed of light, so, to escape this cone, s/he would have to go faster than light, which is impossible.

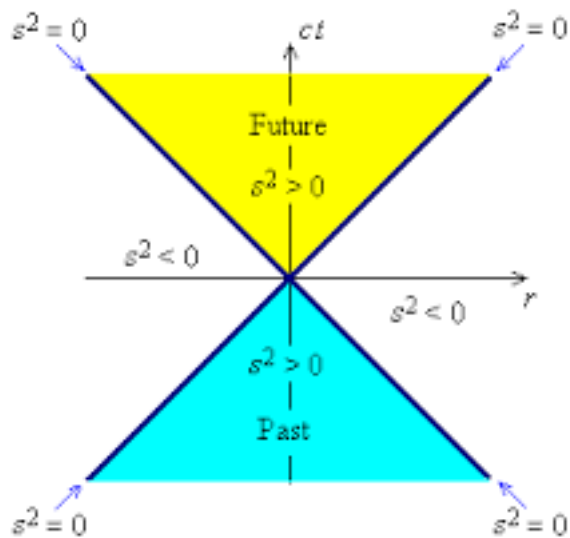
Like this, if there was a big sphere of light collapsing back on itself, then everything he would have done in the past would have happened in that cone due to the same reason that he cannot go faster than light. Here is a diagram



Now that we understand the basics required to understand the diagram, we can continue onwards to deeper understand the working of this diagram.

First, let us get the idea of what this diagram is representing. Here, the diagonal square that is labelled “universe” represents the entire universe as compressed to a square for the sake of simplicity because the universe extends outwards infinitely. The “r” coordinates represent how far we are from the center. Here, after making the light cones be at 45 degrees like

we are used to as so:

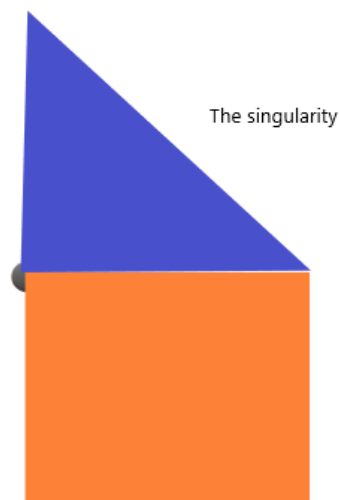


(ignore the other stuff, just focus on the shape and degree)

After doing this, the singularity is now a line. We can understand this as, all the light cones are pointing towards the singularity, and are 45 degrees, while being tilted, hence, the singularity also appears to be a line that is tilted. It is flat as all the tops of the light cones are flat.

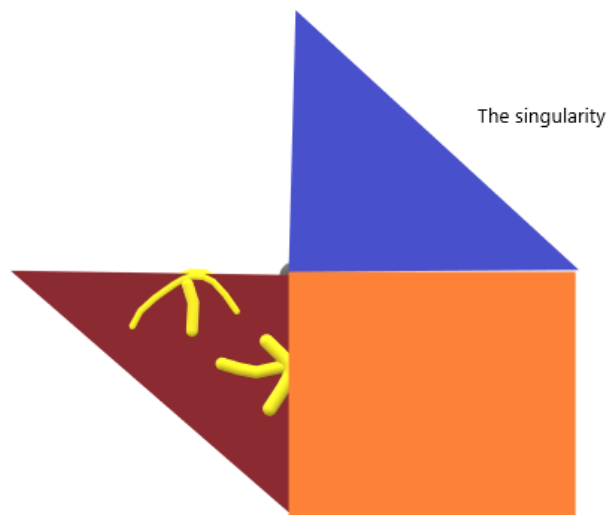
The connection between the white and black hole and the two universes

Let us imagine, for a moment, that you were standing here: -



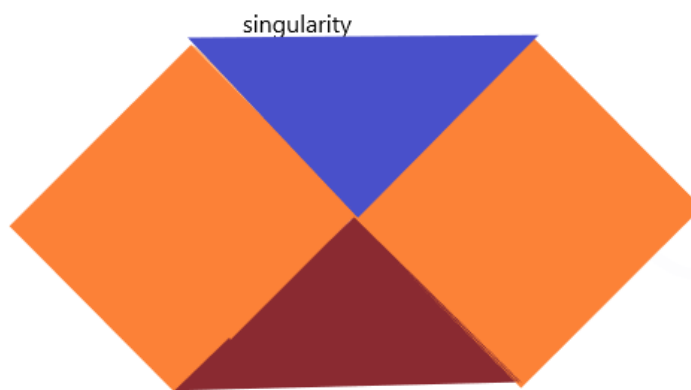
Now imagine you were standing on the grey point, on the border of the universe and the event horizon, then your future cone will sign towards the black hole, but what will your past cone sign towards, it should be signing towards something, after all... Well, it will point to a white hole, which is the mathematical opposite of a black hole, which ejects matter instead of pulling it in.

Now, we have a diagram that looks a bit like this:



Now, if you are inside the white hole, then, you can be ejected in either of the two directions that the yellow arrows are depicting, if you take the first path back to our universe, then you will simply come back. But what if you get ejected through the second path, then, you will end up in another, parallel universe, where things happen differently than our universe. *Also, the diagram is sideways here for helping you understand*

Now, our diagram looks like this



Now, let us understand what the other terms in the original diagram meant (the terms we didn't understand in the beginning)

As disclosed before, the “ r ” shows how away you are from the singularity, so at $r = \text{infinity}$, you are infinitely far away from the singularity. The horizon is the horizon of the black hole and the parallel horizon the parallel universe counterpart of the horizon and the Anti horizon is the horizon of the whit hole, and the parallel Anti horizon is its parallel universe counterpart.

Problems with using wormholes for travelling

Now, you may be thinking that we can use wormholes to travel between universes. But this diagram is just a theory, general relativity does not only consist of geometries, but other components too. Either way, considering that we somehow reach a black hole, because even the nearest one is light years away. You see, wormholes are not stable in time, so, their dimensions keep changing, hence, travelling through one is impossible, because it would collapse

Thank you